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MYCOFLORA OF BROAD BEAN, CHICK-PEA AND LENTIL SEEDS IN EGYPT

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ABSTRACT - 69 species in addition to 4 varieties which belong to 22 genera were collected from 32 samples of each of broad bean, chick-pea and lentil seeds gathered from eight Governorates in Egypt on glucose-(18 genera and 59 species + 4 var.) and cellulose-(15 genera and 48 species + 2 var.) Czapek's agar at 28°C. The results obtained from the 3 types of seeds and on the 2 types of media were basically similar with the most frequent genera were *Aspergillus, Penicillium, Rhizopus, Mucor* and *Fusarium*. From the preceding genera *A. niger, A. flavus, A. nidulans, A. terreus, A. flavus* var. *columnaris, P. chrysogenum, P. citrinum, P. funiculosum, R. stolonifer, M. hiemalis* and *F. moniliforme* were the most prevalent. Also, several fungi were common or recovered only on cellulose agar plates such as *Chaetomium globosum, C. olivaceum, C. spirale, Acremonium strictum, Stachybotrys chartarum, Microascus trigonosporus, Beauveria bassiana* and *Macrophomina phaeolina*.

RÉSUMÉ - A partir de graines de fèves, de pois chiche et de lentilles (32 lots de chaque provenant de 8 régions d'Egypte), 69 espèces et 4 variétés de champignons, appartenant à 22 genres, ont été isolées sur milieu Czapek contenant du glucose (18 genres et 59 espèces + 4 var.) ou de la cellulose (15 genres et 48 espèces + 2 var.) à 28°C. Les résultats sont équivalents pour les 3 types de graines et les 2 milieux avec, pour genres les plus fréquents, *Aspergillus, Penicillium, Rhizopus, Mucor* et *Fusarium*. Parmi ces genres *A. niger, A. flavus, A. nidulans, A. terreus, A. flavus* var. *columnaris, P. chrysogenum, P. citrinum, P. funiculosum, R. stolonifer, M. hiemalis* et *F. moniliforme* sont les espèces prépondérantes. Plusieurs champignons sont également fréquents ou n'ont été trouvés que sur cellulose: *Chaetomium globosum, C. olivaceum, C. spirale, Acremonium strictum, Stachybotrys chartarum, Microascus trigonosporus, Beauveria bassiana* et *Macrophomina phaseolina*.

KEY WORDS : seed-borne fungi, broad bean, chick-pea, lentil, glucophilic fungi, cellulose-decomposing fungi.

INTRODUCTION

Numerous investigations have been carried out on the seed- and grain- borne fungi all over the world (ABDEL-HAFEZ, 1984a-b; CHRISTENSEN & KAUFMANN, 1969; HANLIN, 1969; FLANNIGAN, 1978; LUTEY, 1963, and several others) due to the deterioration of seeds and grains and production of mycotoxins by associated fungi and their hazards to animal, bird and human

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health (mycotoxicoses diseases) when used these seed and grain as feed and foodstuffs.

In Egypt, information on the mycoflora of legumes crops is very limited and most studies were focused on cereal grains (ABDEL-KADER & al., 1979; AS-SAWAH & ELAROSI, 1960; EL-KADY & al., 1982; MOUBASHER & al., 1972). Broad bean, chick-pea and lentil seeds are of the basic foods of people in Egypt, production of the previous three types of seeds were about 310000, 20000 and 15000 tons in 1986 respectively, more than or sufficient for national consumption. So that information on the composition, numbers and frequency of occurrence of glycophilic and cellulose-decomposing fungi of broad bean, chick-pea and lentil seeds are of importance.

MATERIALS AND METHODS

Thirty-two samples of each of broad bean (*Vicia faba* L.), chick-pea (*Cicer arietinum* L.) and lentil (*Lens culinaris* Medicus) seeds of the crop of 1986, of 0.5 kg each, were collected from eight Governorates in Egypt namely Cairo, Giza, Beni-Suef, El-Minya, Assiut, Sohag, Qena and Aswan. The number of samples from each Governorate and from each type of seeds was four. Each sample was put in a sterile polyethylene bag sealed and put in another bag which was also sealed. Storage of seeds in a double-bag container minimize the loss of water content and yet gives sufficient aeration. Samples were kept in a cool place during storage (3-5°C).

Determination of moisture content of seeds

Replicate samples of seeds were milled and a weighed portion of their powder was dried in an oven for 24 h at 105°C, then cooled in a desiccator and re-weighed. The moisture content is expressed as percentage of the dry-weight.

Determination of germinability of seeds

100 seeds of each of broad-bean, chick-pea and lentil were incubated at 25°C over a pad of moist sterile filter paper placed in ■ sterile petri-dish for 8-12 days during which the seeds with healthy roots and plumules were counted and the counts are expressed as percentages of the numbers of tested seeds.

Determination of seed-borne fungi

This was made by using the seed-plate method as employed by MOUBASHER & al. (1972). Glucose-(10 g/l) and cellulose-(19 g/l) Czapek's agar were used for isolation of glycophilic and cellulose-decomposing fungi, respectively. Rose bengal (1/15000) was used as a bacteriostatic agent (SMITH & DAWSON, 1944). Five seeds of each of broad bean, chick-pea and lentil seeds were placed on the surface of each of sterile glucose- and cellulose-Czapek's agar medium. Ten plates were used for each sample (5 for each medium). The plates were incubated at 28°C for 7-10 days and the developing fungi were counted, identified and calculated per 25 seeds. The colonies of slow growing fungi were transferred to slants to ensure precise counting and then to plates for identification. Other agar media were also used (Czapek's + 0.05 yeast extract, malt agar and potato dextrose agar) for identification of fungi.

RESULTS AND DISCUSSION

The moisture content of broad bean, chick-pea and lentil samples (on oven-dry basis) was considerably low and ranged between 5.6-7.9%, 6.4-8.7% and 4.9-6.5%, respectively. This means that the ability of associated fungi to grow, penetrate and damage the embryos of seeds during storage is low since fungi growth is dependent on high levels of moisture in seeds. Therefore, there is no appreciable differences between the germinability of the three types of seeds tested and the germination rate of the previous seeds ranged from 98% to 100%.

Glycophilic fungi

The total count of fungi in seed samples tested fluctuated between 9-79, 30-84 and 5-56 colonies per 25 seeds of broad bean, chick-pea and lentil, respectively. It is axiomatic that seed samples with high values of moisture contents contained high numbers of fungi and vice versa. The highest numbers of glycophilic fungi was recorded in chick-pea (1835 colonies per 25 seeds in every samples) followed by broad bean (1570 colonies) and lentil seeds (975 colonies).

Fifty-nine species in addition to 4 varieties which belong to 18 genera were collected from 32 samples of each of broad bean (15 genera and 45 species + 3 var.), chick-pea (13 genera and 45 species + 3 var.) and lentil seeds (12 genera and 35 species + 2 var.) on glucose-Czapek's agar at 28°C (Tabl. 1-2). Most of these species were firstly isolated from Egyptian legumes seeds, but almost the majority of them were recovered previously from cereal grains and peanut seeds (ABDEL-KADER & al., 1979; ASSAWAH & ELAROSI, 1960; EL-HELALY & al., 1968a-b; EL-KADY & al., 1982; MOUBASHER & al., 1972).

Aspergillus was the most common genus and was emerged from approximately 100 %, 97% and 94% of the samples contributing 55.7%, 54.2% and 43.6% of total fungi in broad-bean, chick-pea and lentil seeds, respectively. It was represented by 21 species and 3 varieties (15 + 2, 16 + 3 and 12 species + 2 var. in broad bean, chick-pea and lentil seeds, respectively) of which *A. niger*, *A. flavus* and *A. nidulans* were the most prevalent in the three types of seeds. They occurred in about 50-97% of the samples comprising 4.2-59.9% of total *Aspergillus* and 2.3-32.8% of total fungi in the 3 substrates tested. ABDEL-HAFEZ (1984b) isolated 16 species and 2 varieties of *Aspergillus* from 10 samples of each bean, broad bean, lentil, lupine and pea seeds collected from Saudi Arabia (Taif and El-Baha regions) and the most common species were *A. niger* and *A. flavus* on the 5 types of seeds. PARVEEN & DHIRENDRA (1981) isolated *A. niger*, *A. sydowi*, *A. terreus*, *A. flavus* and *A. nidulans* from 4 different samples of lentil seeds from India. It is worthmentioning that several members of *Aspergillus niger* and *A. flavus* groups are widely distributed in soils and air and other substrata including stored seeds and grains, spoiled fruits and vegetables, animal and plant residues and various types of food product; cosmopolitan. Also, several isolates of *A. flavus*, *A. ochraceus* and *A. nidulans* which isolated from seeds and grains are well known that have the ability to produce mycotoxins (aflatoxins, ochratoxins and sterigmatocystins, respectively) as reported by numerous workers (F.A.O., 1979; MIŠLIVEC & al., 1975; SCOTT & al., 1972; SCHROEDER & BOLLER, 1973; EL-KADY & al., 1984). These compounds (mycotoxins) have been implicated in diseases of human and as causing mycotoxicoses in animals and fowls (DAVIS & DIENER, 1978; EL-ZAWAHIRI & al., 1977; SCOTT & al., 1970; SMALLEY & STRONG, 1974). *A. terreus* (34.4% of the samples, 2.4% of total *Aspergillus* and 1.3% of total fungi) and *A. flavus* var. *columnaris* (28.1%, 2.9% and 1.6%) in broad bean; *A. terreus*

Genera	GLUCOSE									CELLULOSE								
	Broad bean			Chick-pea			Lentil			Broad bean			Chick-pea			Lentil		
	[illegible]	%C	%F	NS	%C	%F	NS	%C	%F	NS	%C	%F	NS	[illegible]	%F	[illegible]	%C	%F
Aspergillus	15+2 var.	55.7	100	16+3 var.	54.2	96.9	12+2 var.	43.6	93.8	12+2 var.	59.2	100	14+2 var.	61.3	96.9	11+2 var.	48.4	93.8
Penicillium	10	28.7	96.9	11	29.1	93.8	8	36.9	90.6	9	22.3	84.4	[illegible]	19.0	81.3	7	18.5	62.5
Rhizopus	[illegible]	7.9	78.1	[illegible]	9.5	84.4	[illegible]	7.7	65.6	[illegible]	7.2	71.9	3	9.3	75.0	2	21.9	81.3
Mucor	3	2.7	46.9	2	1.5	34.4	3	4.7	43.8	2	2.0	31.3	2	1.1	28.1	2	3.4	21.9
Fusarium	4	0.8	28.1	5	1.0	31.3	3	0.7	12.5	2	1.6	18.8	4	1.8	31.3	1	1.9	9.4
Syncephalastrum	1	1.3	21.9	1	0.2	6.3	1	1.2	15.6	-	-	-	-	-	-	-	-	-
Circinella	1	0.6	18.8	1	0.3	12.5	1	1.4	18.8	-	-	-	-	-	-	-	-	-
Cladosporium	1	0.6	15.6	1	0.2	6.3	1	1.6	12.5	1	0.1	3.1	-	-	-	1	0.5	6.3
Neurospora	1	0.4	12.5	1	0.3	9.4	-	-	-	-	-	-	-	-	-	-	-	-
Trichoderma	1	0.4	12.5	1	0.2	3.1	1	0.1	3.1	-	-	-	-	-	-	-	-	-
Alternaria	1	0.2	6.3	1	0.2	9.4	1	0.3	6.3	1	0.3	6.3	1	0.2	3.1	-	-	-
Botryotrichum	1	0.1	6.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaetomium	1	0.1	6.3	-	-	-	-	-	-	3	2.9	25.0	3	3.2	28.1	2	2.7	15.6
Humicola	1+1 var.	0.1	6.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acremonium	1	0.1	3.1	-	-	-	-	-	-	1	0.5	6.3	1	0.3	6.3	1	0.1	3.1
Drechslera	-	-	-	1	0.4	9.4	1	0.5	6.3	-	-	-	1	0.2	3.1	-	-	-
Scopulariopsis	-	-	-	1	0.1	3.1	-	-	-	-	-	-	-	-	-	-	-	-
Paecilomyces	-	-	-	-	-	-	1	0.5	9.4	-	-	-	1	0.1	3.1	1	0.3	3.1
Stachybotrys	-	-	-	-	-	-	-	-	-	1	1.1	12.5	1	1.1	15.6	1	1.0	9.4
Microascus	-	-	-	-	-	-	-	-	-	1	0.5	9.4	1	0.1	3.1	1	0.3	3.1
Beauveria	-	-	-	-	-	-	-	-	-	1	1.1	6.3	1	0.6	9.4	1	0.1	3.1
Macrophomina	-	-	-	-	-	-	-	-	-	1	0.3	6.3	1	0.2	6.3	1	0.1	3.1
Sterile mycelium	1	0.3	9.4	1	2.8	31.3	1	0.8	12.5	1	0.9	15.6	1	1.5	25.0	1	0.8	6.3
Total	45±3 var.	100	-	45±3 var.	100	-	35±2 var.	100	-	38±2 var.	100	-	42±2 var.	100	-	32±2 var.	100	-

Table 1 - Number of species (NS), percentage counts (%C, calculated per total counts of fungi) and percentage frequency of occurence (%F, calculated per 32 samples) of various genera recovered from broad bean, chick-pea and lentil seeds on glucose- and cellulose-Czapek's agar at 28°C.

Tableau 1 - Nombres d'espèces (NS), pourcentages (%C) et fréquences d'apparition (%F) des différents genres isolés de graines de fèves, de pois chiche et de lentilles sur milieu Czapek (glucose et cellulose) à 28°C.

(31.3%, 2.2% and 1,2%) and *A. fumigatus* (25%, 1.2% and 0.65%) in chick-pea; and *A. terreus* (25%, 3.1% and 1.3%) and *A. ochraceus* (25%, 3.3% and 1.4%) in lentil seeds were isolated in moderate frequency of occurrence. The previous *Aspergillus* species were isolated, but with variable numbers and frequency, from Saudi Arabian leguminous crops (ABDEL-HAFEZ, 1984b). ABDEL-HAFEZ & SHOREIT (1986a) recorded that *A. niger, A. flavus, A. terreus, A. fumigatus* and *A. ochraceus* or *A. nidulans* was the most common in some Egyptian legumes crops. The remaining *Aspergillus* species were less frequent and accounting collectively 7.9-11.8% of total *Aspergillus* and 4.4-6.2% of total fungi in the previous three types of seeds (Tabl. 2).

Penicillium was the second most common genus and encountered in nearly 97%, 94% and 91% of the samples comprising 28.7%, 29.1% and 36.9% of tot-

al fungi in broad bean, chick-pea and lentil seeds, respectively. From the genus 14 species (10, 11 and 8 species in the 3 types of seeds, respectively) were collected of which *P. chrysogenum*, *P. citrinum* and *P. funiculosum* were the most common; these occurred in about 13-91% of the samples giving rise to 6.9-66.7% of total *Penicillium* and 2.2-24.6% of total fungi in seeds tested. ABDEL-HAFEZ & SHOREIT (1986a) found that the previous species were prevalent, but with variable numbers and frequency, from some legumes seeds collected from Upper Egypt. ABDEL-HAFEZ (1984b) identified 14 species of *Penicillium* from bean, broad bean, lentil, lupine and pea seeds gathered from Taif and EL-Baha regions at Saudi Arabia, and who found that *P. citrinum* in bean; *P. citrinum*, *P. corylophilum*, *P. frequentans*, *P. notatum* and *P. oxalicum* in broad bean; *P. brevicompactum* and *P. citrinum* in lentil; *P. citrinum* and *P. notatum* in lupine; and *P. chrysogenum*, *P. citrinum* and *P. funiculosum* in pea seeds were the most prevalent. The remaining *Penicillium* species were less frequent and listed in Table 2.

Rhizopus, ranked third in the number of cases of isolation. It emerged in about 78%, 84% and 66% of the samples contributing 7.9%, 9.5% and 7.7% of total fungi in broad bean, chick-pea and lentil seeds, respectively. From the genus 3 species were collected of which *R. stolonifer* was the most common in the 3 types of seeds. This species was also common in some seeds and grains collected from Egypt (MOUBASHER & al., 1972; ABDEL-KADER & al., 1979; EL-HELALY & al., 1968a-b; ABDEL-HAFEZ & SHOREIT, 1986a) and Saudi Arabia (ABDEL-HAFEZ, 1984a-b). *R. oryzae* and *R. arrhizus* were less frequent (Tabl. 2).

Mucor, ranked fourth in the number of cases of isolation and occurred in approximately 47%, 34% and 44% of the samples comprising 2.7%, 1.5% and 4.7% of total fungi in broad bean, chick-pea and lentil seeds, respectively. It was represented by 3 species of which *M. hiemalis* was the most prevalent; *M. circinelloides* and *M. racemosus* were less frequent. ABDEL-HAFEZ & SHOREIT (1986a) isolated *M. hiemalis* and *M. circinelloides* from Egyptian bean, lupine and pea seeds. ABDEL-HAFEZ (1984b) collected 4 species of *Mucor* from 5 types of leguminous seeds of Saudi Arabia of which *M. hiemalis* in broad bean, lentil and pea; and *M. racemosus* in bean and lupine seeds were the most common. *M. circinelloides* and *M. pusillus* were less frequent and were isolated only from broad bean and bean.

Fusarium was isolated in moderate or low frequency of occurrence from seeds tested and occurred from nearly 28%, 31% and 13% of the samples comprising 0.8%, 1% and 0.7% of total fungi in broad bean, chick-pea and lentil seeds, respectively. Five species were identified and these were *F. moniliforme*, *F. graminearum*, *F. oxysporum*, *F. solani* and *F. semitectum*. ABDEL-HAFEZ (1984b) isolated *F. moniliforme*, *F. oxysporum* and *F. solani* from legumes seeds at Saudi Arabia. The remaining genera and species were of low or rare frequency and accounting collectively for 4.2%, 4.6% and 6.4% of total fungi in the 3 types of seeds, respectively (Tabl. 2). SUMMAR & HOWARD (1983) found that the common microflora in dry peas, processing and dry beans, fababeans, lentils and soybeans from Alberta (Canada) were species of field fungi: *Alternaria*, *Penicillium*, *Rhizopus*, *Fusarium* and *Botrytis*.

Genera and species	GLUCOSE						CELLULOSE					
	Broad bean		Chick-pea		Lentil		Broad bean		Chick-pea		Lentil	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI
Total count	1570	-	1835	-	975	-	1325	-	1420	-	785	-
Aspergillus	875	32	995	31	425	[illegible]	785	32	870	31	380	30
A. niger Van Tiegh.	515	31	520	30	170	29	395	30	370	31	102	28
A. flavus (Link) Fres.	205	30	285	28	146	24	175	29	243	28	75	26
A. nidulans Eidam	40	19	42	17	32	16	[illegible]	16	38	21	35	19
A. terreus Thom	21	11	22	10	13	8	42	9	48	13	32	9
A. flavus var. *columaris* Link	25	9	42	7	12	5	50	13	55	16	42	10
A. nidulans var. *latus* Thom & Raper	14	6	8	3	[illegible]	[illegible]	15	8	10	7	11	[illegible]
A. ochraceus Wilhelm	13	5	22	7	14	8	15	6	18	7	12	6
A. fumigatus Fres.	10	4	12	8	12	[illegible]	35	10	45	10	55	[illegible]
A. tamarii Kita	9	4	8	3	7	2	7	3	[illegible]	2	4	2
A. ustus (Bain.) Thom [illegible] Church	5	3	-	-	3	1	3	2	-	-	-	-
A. versicolor (Vuill.) Tirab.	5	2	12	[illegible]	-	-	-	-	8	2	-	-
A. rugulosus Thom [illegible] Raper	4	2	-	-	-	-	12	4	7	3	4	1
A. clavatus Desmazieres	2	2	2	1	6	4	-	-	-	-	-	-
A. flavipes (Bain. [illegible] Sart.) Thom& Church	2	1	-	-	-	-	-	-	-	-	-	-
A. parasiticus Speare	2	1	3	1	-	-	-	-	2	1	-	-
A. sydowi (Bain. & Sart.) Thom & Church	2	1	4	2	3	2	-	-	6	2	2	1
A. candidus Link ex Fr.	1	1	-	-	-	-	-	-	-	-	-	-
A. egyptiacus Moubasher & Moustafa	-	-	2	2	-	-	-	-	-	-	-	-
A. zonatus Kwon & Fennell	-	-	4	2	-	-	-	-	-	-	-	-
A. [illegible] (Van Tiegh.) Blochwitz	-	-	2	1	-	-	-	-	-	-	-	-
A. quadrilineatus Thom & Raper	-	-	2	1	1	1	5	2	10	4	5	3
A. ruber Thom & Church	-	-	1	1	-	-	-	-	-	-	-	-
A. niveus Blochwitz	-	-	-	-	1	1	2	1	2	2	1	1
A. nidulans var. *acristatus* Fennell & Raper	-	-	2	1	-	-	-	-	-	-	-	-
A. malleus Yukawa	-	-	-	-	-	-	[illegible]	-	2	1	-	-
A. oryzae Wehmer	-	-	-	-	-	-	-	1	-	-	-	-
Penicillium	450	31	535	30	360	29	295	27	270	26	145	20
P. chrysogenum Thom	203	28	285	29	240	27	122	[illegible]	105	22	55	16
P. citrinum Thom	85	12	102	11	57	7	51	19	57	12	42	9
P. funiculosum Thom	[illegible]	9	40	7	25	4	36	13	35	8	23	5
P. oxalicum Thom	27	[illegible]	[illegible]	6	14	3	24	10	40	6	14	4
P. jensenii Zaleski	24	4	16	3	2	1	18	7	12	4	6	2
P. nigricans Bainier	18	3	24	4	[illegible]	2	21	6	13	[illegible]	4	2
P. brevi-compactum Dierckx	16	3	25	5	11	3	14	5	6	2	-	-
P. cyclopium Westling	6	2	-	-	-	-	4	2	-	-	-	-
P. frequentans Westling	4	1	8	2	-	-	-	-	-	-	-	-
P. corylophilum Dierckx	2	1	-	-	-	-	-	-	-	-	-	-
P. rubrum Sopp	-	-	2	1	-	-	-	-	-	-	-	-
P. stoeckii Zaleski	-	-	2	1	-	-	5	2	-	-	-	-
P. duclauxi Delacroix	-	-	1	1	-	-	-	-	-	-	-	-
P. janthinellum Biourge	-	-	-	-	2	1	-	-	-	-	-	-
P. albidum Sopp	-	-	-	-	-	-	-	-	-	-	1	1
P. viridicatum Westling	-	-	-	-	-	-	-	-	2	1	-	-
Rhizopus	124	25	175	27	75	21	[illegible]	23	132	24	172	26
R. stolonifer Ehren. [illegible] Fr. Lindt	75	22	120	25	60	18	75	20	102	23	137	21
R. oryzae Went & Gerlings	31	6	37	7	15	4	15	7	26	9	35	8
R. arrhizus Fischer	18	3	18	4	-	-	6	2	4	1	-	-
Mucor	43	15	28	11	46	14	27	10	16	9	27	7
M. hiemalis Wehmeyer	24	11	18	7	25	9	19	6	10	[illegible]	21	[illegible]
M. circinelloides Van Tieghem	15	6	10	4	14	5	8	4	[illegible]	3	6	[illegible]
M. racemosus Fresenius	4	2	-	-	7	3	-	-	-	-	-	-
Fusarium	12	9	18	10	7	4	21	6	26	10	15	3
F. moniliforme Sheldon	6	4	8	[illegible]	[illegible]	2	18	[illegible]	20	7	15	3
F. graminearum Schwabe	3	2	4	2	-	-	3	2	[illegible]	2	-	-
F. oxysporum Schlecht.	2	2	3	[illegible]	2	1	-	-	1	1	-	-
F. solani (Mart.) Sacc.	1	1	1	1	2	1	-	-	2	1	-	-
F. semitectum Berk. [illegible] Rav.	-	-	2	1	-	-	-	-	-	-	-	-
Syncephalastrum racemosum (Cohn) Schroet.	20	7	4	2	12	5	-	-	-	-	-	-
Circinella muscae (Sorok.) Berl. & De Toni	10	6	5	4	13	[illegible]	-	-	-	-	-	-
Cladosporium herbarum (Pers.) Link ex Fr.	9	5	3	2	15	4	2	1	-	-	4	2
Neurospora crassa Shear [illegible] Dodge	7	4	5	3	-	-	-	-	-	-	-	-
Trichoderma viride Pers. ex Gray	6	4	3	1	1	1	-	-	-	-	-	-

Cellulose-decomposing fungi

The total count of putative cellulose-decomposing fungi in seed samples tested fluctuated between 5-58, 17-63 and 3-42 colonies per 25 seeds of broad bean, chick-pea and lentil, respectively. The highest counts of this group of fungi as in case of glycophilic fungi was also obtained in samples with relatively high moisture contents and vice versa. Forty-eight species and 2 varieties belonging to 15 genera were collected on cellulose-Czapek's agar plates at 28°C, which means a narrower spectrum of genera and species than on glucose agar and this is reasonable since glucose is a more easily utilizable carbohydrate by fungi. The results obtained on cellulose agar plates were basically similar to those on glucose with the most frequent genera being *Aspergillus, Penicillium, Rhizopus, Chaetomium, Fusarium, Mucor* and *Stachybotrys*. They emerged from about 9-100% of the samples comprising 1-61.3% of total fungi in seeds examined. From the preceding genera, *Aspergillus niger, A. flavus, A. nidulans, A. terreus, A. nidulans* var. *columnaris, P. chrysogenum, P. citrinum, R. stolonifer, Chaetomium globosum, C. olivaceum, F. moniliforme, M. circinelloides* and *Stachybotrys*

Genera and species (Contd.)	GLUCOSE						CELLULOSE					
	Broad bean		Chick-pea		Lentil		Broad bean		Chick-pea		Lentil	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI
Alternaria alternata (Fr.) Keissler	3	2	4	3	3	2	4	2	2	1	-	-
Botryotrichum atrogriseum Van Beyma	2	2	-	-	-	-	-	-	-	-	-	-
Chaetomium	2	2	-	-	-	-	38	8	46	9	21	5
C. globosum Kunze ex Fr.	2	2	-	-	-	-	16	6	18	5	13	4
C. olivaceum Cooke & Ellis	-	-	-	-	-	-	12	4	15	4	8	3
C. spirale Zopf	-	-	-	-	-	-	10	3	13	3	-	-
Curvicola	2	2	-	-	-	-	-	-	-	-	-	-
F. grisea Traaen	1	1	-	-	-	-	-	-	-	-	-	-
F. fuscoatra var. *fuscoatra* Traaen	1	1	-	-	-	-	-	-	-	-	-	-
Acremonium strictum W. Gams	1	1	-	-	-	-	6	2	4	2	1	1
Trichoderma state of *Cochliobolus spicifer* Nelson	-	-	7	3	5	2	-	-	2	1	-	-
Doopulariopsis brevicaulis (Sacc.) Bainier	-	-	1	1	-	-	-	-	-	-	-	-
Paecilomyces variotii Bainier	-	-	-	-	5	3	-	-	1	1	2	1
Stachybotrys chartarum (Ehrenb. ex Link) Hughes	-	-	-	-	-	-	15	4	16	5	8	3
Sphaeroascus trigonosporus Emmons & Dodge	-	-	-	-	-	-	6	3	2	1	2	1
Beauveria bassiana (Bals.) Vuill.	-	-	-	-	-	-	14	2	9	3	1	1
Macrophomina phaseolina (Tassi) Goidy.	-	-	-	-	-	-	4	2	3	2	1	1
Sterile mycelium	4	3	52	10	8	4	12	5	21	8	6	2

TC=total count per 25 seeds in every sample; NCI=number of cases of isolation.
High occurrence: isolated more than 15 cases (out of 32 samples), moderate occurrence: from 8 to 15 cases, low occurrence: from 4 to 7 cases, rare occurrence: less than 4 cases.

Table 2 - Total counts (calculated per 25 seeds of each type in every samples) and number of cases of isolation (out of 32 samples) of fungal genera and species recovered from 32 samples from each of broad bean, chick pea and lentil seeds on glucose- and cellulose-Czapek's agar at 28°C.

Tableau 2 - Genres et espèces de champignons isolés à partir de graines de fèves, de pois chiches et de lentilles (32 lots de chaque) sur milieu Czapek (glucose et cellulose) à 28°C.

chartarum were the most prevalent. They occurred in about 13-94%, 9-97% and 9-88% of the samples comprising 0.6-29.8%, 0.4-26% and 0.8-17.5% of total fungi in the 3 types of seeds, respectively. Most of the preceding species were recovered previously, but with variable numbers and frequency, on cellulose agar plates from some types of seeds and grains collected from Upper Egypt (ABDEL-HAFEZ & ABDEL-KADER, 1980; ABDEL-HAFEZ & SHOREIT, 1986b). Most of the fungal species recovered on cellulose agar plates were reported to be cellulose-decomposing but with variable ability (FLANNIGAN, 1970; MAZEN, 1973; STEWART & WALSH, 1972; TRIBE, 1957, 1961, 1966). The remaining genera and species were less frequent and listed in Table 2.

In conclusion, the present results reveal that *Aspergillus*, *Penicillium*, *Fusarium*, *Mucor* and *Rhizopus* were consistently the most frequent genera in broad bean, chick-pea and lentil seeds on the 2 isolation media. But, *Chaetomium*, *Stachybotrys*, *Beauveria*, *Microascus*, *Macrophomina* and *Acremonium* were common only on cellulose agar plates. Also, comparison between the lists of fungi recovered in the present investigation and from some other legumes seeds in Egypt (ABDEL-HAFEZ & SHOREIT, 1986b), Canada (SUMAR & HOWARD, 1983), India (SHARAMA & SHARAMA, 1978; PARVEEN & DHIRENDRA, 1981) and Saudi Arabia (ABDEL-HAFEZ, 1984b) reveal that there is no fungal flora characteristic of Egyptian leguminous crops, but these list may differ in the numbers and in order of frequency of the component fungi.

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